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Hens, Thorsten

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BOOK REVIEW

Slanina, František: *Essentials of econophysics modelling*.

XIV, 411 pp. Oxford University Press, Oxford, 2013. Hardback, £45.00

Thorsten Hens

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Imagine you have a strange disease that bothers you every day so much that you can hardly work nor have fun. Will you go to see a physicist instead of a physician? Certainly not! So why should economists read a book on economic modeling written by a physicist—is it likely that he better understands the economy than they do?

Being an economist, I believe the answer can well be "yes". The reason is that economics is too much based on methodological individualism—the idea that one can understand the economy by studying individual decisions. Moreover, ever since Adam Smith economists are modeling the interaction of decision makers on markets assuming that the impact between households and firms, the government and other institutions is mainly through prices. These entities are assumed to solve very complicated mathematical decision problems over infinite horizons but the impact of any one decision maker on the others is only through market prices. In physics exactly the opposite is true. One studies the interaction of units (e.g. particles) that do not seem to employ much of what economists would consider a rational calculus but whose actions directly influence each other. As a result many problems economists were unable to solve, as for example, the link between micro and macroeconomics can be solved with the methods of physics.

Econophysics is best known for its applications in asset pricing. For that reason the book starts with so called "stylized facts" (Chapter 2) and their modeling by stochastic processes (Chapter 3). The most prominent stylized fact is that stock market returns are not (log-) normally distributed because there are too many large (negative and positive) returns. This is surprising for economists since most economic models are based on complete rationality implying perfect anticipation of any stock price pattern. Thus "..., the period-to-period price changes of a stock should be random movements,

T. Hens (✉)
University of Zurich, Zurich, Switzerland
e-mail: thorsten.hens@bf.uzh.ch

statistically independent of one another"., as Cootner (The random character of stock prices, MIT-press, 1961) wrote. Applying the central limit theorem the distribution of returns should then be normal. On the other hand econophysics emphasizes the heterogeneity of stock market investors interacting via prices but also directly. These are the so called heterogeneous agent models which the book describes in Chapter 3. The interaction may lead to self-enforcing feedback effects resulting in more severe price movements (bubbles and crashes) than one would expect from the single agent models of financial economics.

Chapter 4 describes econophysics models of market microstructure. These are models in which the nitty-gritty of the price formation process is studied, as e.g. the rules with which order books can be filled. A game theoretic foundation of severe price fluctuations is given by the minority game which is discussed in Chapter 5 of the book. A minority game is a game in which the minority wins. Since all players then have an incentive to be among the minority their actions need to fluctuate. The book explains nicely that this simple structure can produce stylized facts much like the returns of financial markets. The chapters 6 and 8 on network economics and social organization are very technical but they are the best examples for what econophysics can achieve over and above the traditional economic models. The direct interaction of agents leads to macro phenomena like the emergence of hierarchies and social classes that cannot be found on the micro level. Chapter 7 studies the distribution of wealth. It starts studying it in a quite mechanical way by specifying a stochastic process of individual wealth. Then, it introduces an interaction between individual wealth. One result shows that under quite general conditions there is a tendency for wealth to concentrate in the hands of one individual—an observation that calls for redistributive taxes!

Compared to other books on econophysics this book is a delightful work that wraps the hard mathematical content of each topic into a sandwich with a nice historical introduction and a final section entitled "What remains?". The book draws from the wisdom of almost 2000 papers and books, i.e. from approximately 100'000 pages of ideas and insights in economics and physics!

Of course, the saying "nobody is perfect"—also applies to books—except to the bible and Debreu's "Theory of Value", perhaps. So also this book has certain aspects that an economist would have written differently. A minor point is the citation style. The book uses the American Chemical Society (ACS) style which is a number-based citation system, where a number is allocated to a source in the order in which it is cited in the text (if it is cited again, the same number is used). The ACS style hides the author name and the date of publication which is used in the Harvard style that is more common in economics. But what is worse is that in the list of references the titles of the books and papers cited are not mentioned. Besides this formality there are two more important issues. The author thinks too much like a physicist because he seems to believe that in economics there are laws which, like in physics, are universal. To give an example, he writes on page 11: "It was shown empirically a long time ago that stock-market forecasting companies are right as often as they are wrong [106]". Behind the number 106 one then finds in the reference list: A. Cowles, Econometrica 1, 309 (1933). Similarly, on page 12 the author writes "Indeed, the time series of prices was found to be unpredictable in the sense that the price increments are uncorrelated [101]", where 101 is E. F. Fama, Journal of Finance 25, 383 (1970). Of course these are

seminal papers but a more balanced judgment would be that they describe a majority of empirical findings—leaving some room for well-known exceptions. Finally, the author sometimes cites rather unrepresentative works from economics. For example, the only paper he mentions on experimental economics is the one by Arifovic (JPE, 1996). As much as I like this paper, the work of Nobel laureate Vernon Smith on experimental stock market bubbles was more path braking and is also more relevant for the topics of this book.

Nevertheless, I really enjoyed reading the book "Essentials of econophysics modelling" since it helped me to organize my scattered knowledge in econophysics into a well-rounded picture.

The book will be of great benefit to researchers in economics to cure their disease called traditional economic thinking that I believe must bother them every day so much that they can hardly work nor have fun.